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Canoe Creek Watershed Health Report

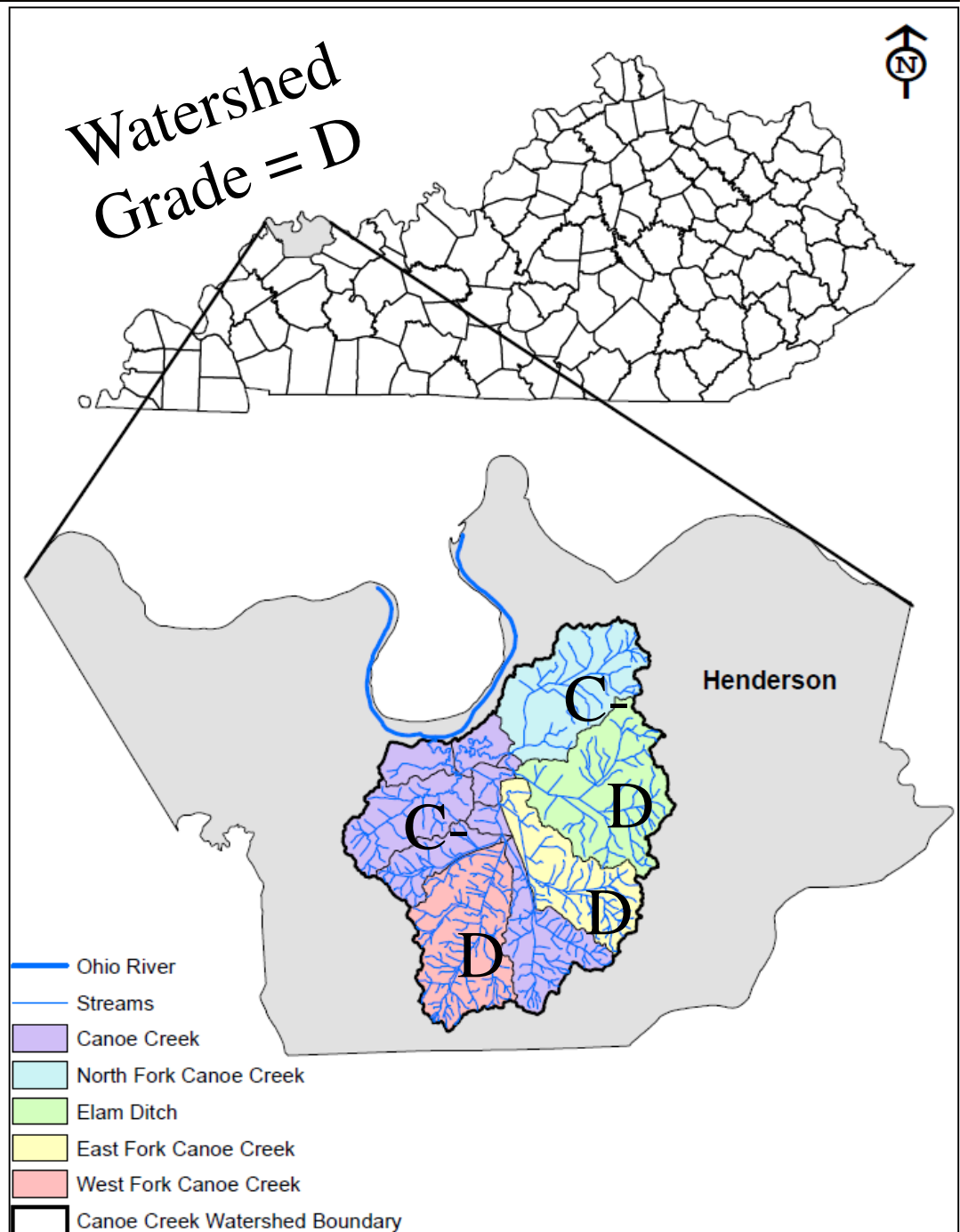
Department for Environmental Protection - Division of Water

The Kentucky Division of Water (DOW) is the state agency responsible for carrying out the requirements of the Clean Water Act to reach the goal of making all waters in Kentucky safe for swimming and fishing (called **designated uses**).

DOW has developed this health report to inform the residents of Henderson County of efforts to examine the health of the Canoe Creek Watershed. A **watershed** is an area of land where runoff flows to a common stream. When streams come together, the two streams' watersheds combine to make a larger watershed. This report discusses North Fork Canoe Creek, Elam Ditch, East Fork Canoe Creek and West Fork Canoe Creek, which form the Canoe Creek Watershed.

Upon initial evaluation, it was determined that many stream segments within the Canoe Creek Watershed do not support the **uses** required by the Clean Water Act.

The U.S. Environmental Protection Agency (EPA) requires that states conduct watershed studies on all such non-supporting waters to calculate the maximum amount of pollution a creek can receive and still support a healthy watershed. This amount is known as a **Total Maximum Daily Load**, or TMDL.

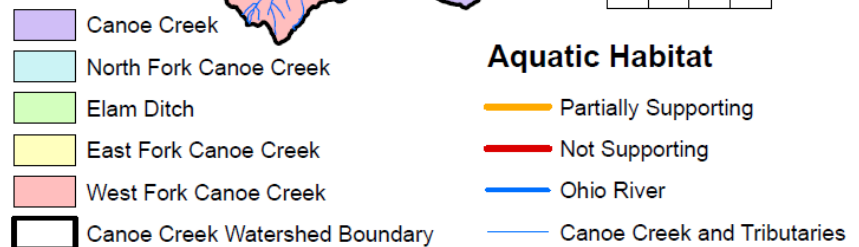
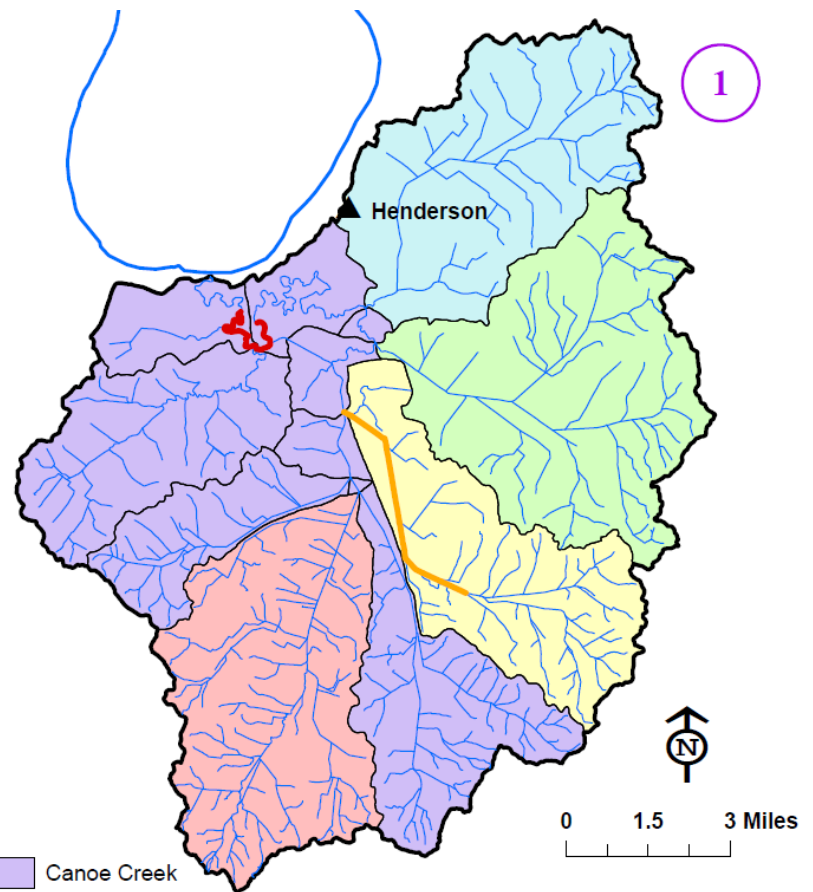


In 2010, DOW biologists conducted a year-long study in each of the watersheds shown in the map above to gather scientific information. Based on this information, the DOW has given a "report card grade" of a **C-** to **Canoe Creek**, a **C-** to **North Fork Canoe Creek**, a **D** to **Elam Ditch**, a **D** to **East Fork Canoe Creek**, a **D** to **West Fork Canoe Creek**, and a **D** to the entire **Canoe Creek Watershed**. This health report explains where the impaired segments are located, the signs of health that went into assigning the grades for each watershed and information on how the grades can be improved.

Impaired Waters

Designated uses for Canoe Creek Watershed are **Aquatic Habitat (map 1)** - water quality promotes a healthy population of plants and animals that live in the water and **Primary Contact Recreation (map 2)** - water is safe for human swimming. In the maps on this page, segments that have been assessed are highlighted in **(1) orange** if the water quality is fair and the use is only partially supported and **(2) red** if the water quality is poor and the use is not supported. If a segment is **blue**, its uses have not yet been assessed.

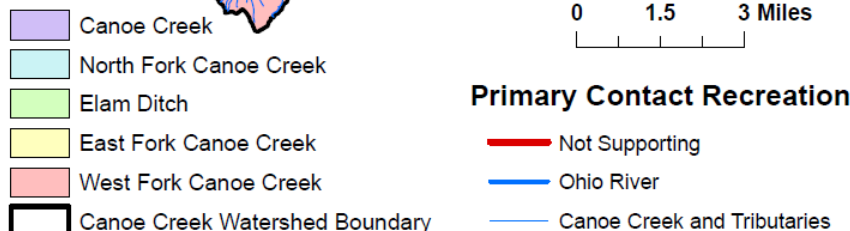
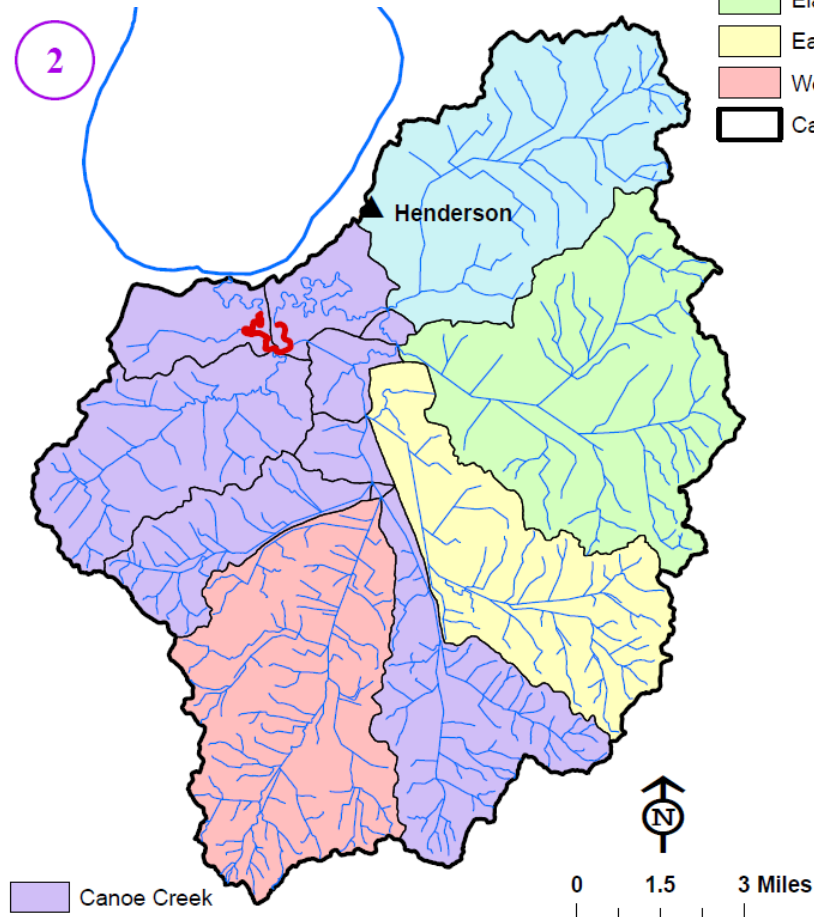
Impaired waters are those that are highlighted in **orange** or **red** since the **designated use** is not fully supported. In stream segments with impaired Aquatic Habitat, fish and aquatic bug communities have reduced numbers or types. Stream segments impaired for Primary Contact Recreation have bacteria concentrations that exceed the level considered safe for swimming at least 20 percent of the time from May through October.



When it is determined that a waterbody is impaired, the pollutant that is causing the impairment is identified. Impaired waters are required to have a **Total Maximum Daily Load (TMDL)** calculated for each pollutant identified. A TMDL calculation is the total amount of pollutant(s) a waterbody can receive and still meet its **designated use(s)**.

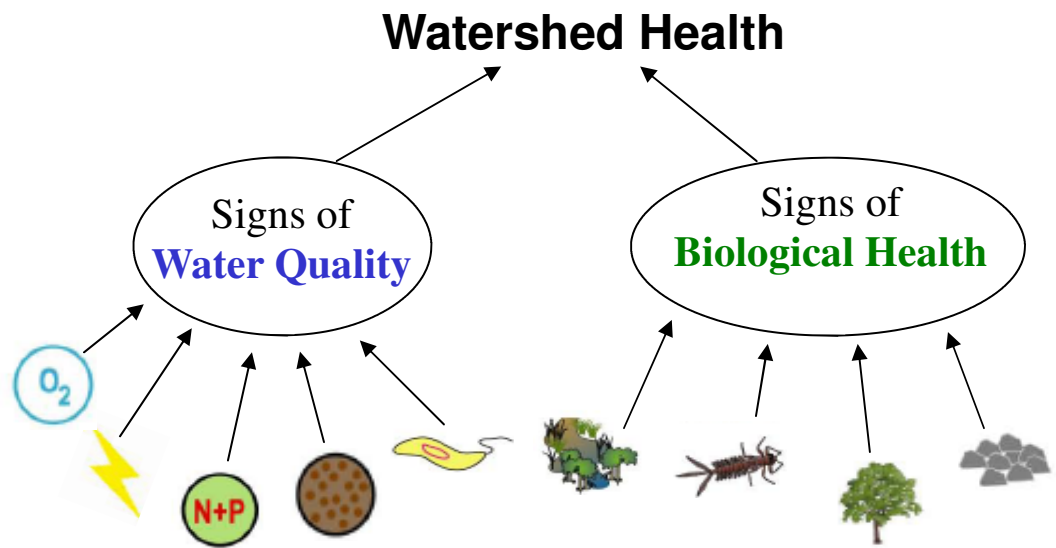
A year long water quality study is performed to collect the data required to calculate a TMDL. The water quality study focuses on collecting data that relates to signs of water quality and signs of biological health, which are described on the next page.

Canoe Creek and East Fork Canoe Creek are listed as impaired and were therefore studied in 2010. North Fork Canoe Creek, Elam Ditch, East Fork Canoe Creek, and West Fork Canoe Creek had not been assessed and were studied to determine if impairments are present. A TMDL report for each watershed will be written as a result of these studies, which will be made available to the public with the goal of improving water quality.



Grading System

1. Data collected were divided into signs of **water quality** or signs of **biological health**.
2. Each sign received a grade, A through F, according to the results of our study, which were compared to health and science requirements and DOW scientific information.
3. The grades from each biological health sign were averaged to achieve a biological health score.
4. Similarly, each sign of water quality was averaged to achieve a water quality score.
5. These two scores were averaged to achieve a **watershed health grade**.



The grades can also be used to compare **sites** or **signs**. For example, one site within a watershed may receive a higher grade than the other sites in that watershed, demonstrating its quality. Or, one sign may receive a higher grade than the other signs, demonstrating that particular aspect of watershed health is doing well.

Signs of Water Quality



Dissolved Oxygen (DO): Concentration of oxygen dissolved in water and readily available to fish and other aquatic organisms.



Specific Conductivity: A measure of the ability of water to conduct an electrical current, which is used for approximating the total dissolved solids content of water. Low specific conductivity is desired, and increasing specific conductivity negatively impacts fish and aquatic bugs.



Nitrogen and Phosphorus (Nutrients): Although natural sources of nutrients exist, major sources of nutrient pollution are typically caused by man's activities and include municipal sewage-treatment plants, industrial outflows, commercial fertilizers and animal waste.



E. Coli: A type of bacteria that lives in the intestinal tract of man and other warm-blooded animals. For a site to receive an F, the *E. coli* concentration was above the level considered safe for swimming 80 to 100 percent of the time. Elevated concentrations of *E. coli* increase the risk of gastrointestinal illness if the water is swallowed or infection if contact is made with an open sore or wound.



Total Suspended Solids (TSS): A measure of the suspended solids in waterbodies. Suspended solids are small particles of solid pollutants that float on the surface of, or are suspended in, water. As TSS increase, fish and aquatic bugs experience stress and altered behavior.

Signs of Biological Health



Total Habitat: Stream habitat is assessed by scoring 10 habitat signs, which are both living and nonliving parts of the surroundings that support an organism, population or community.



Aquatic Macroinvertebrates (bugs): An animal without a backbone, large enough to be seen with the naked eye. They are often the immature forms of insects that live on land as adults and are an important food source for fish. Different species prefer different habitats, and some are more tolerant of pollution than others.












Riparian Zone: A component of total habitat that is defined by the land adjacent to a stream that has distinct soil types and plant communities, which aid in absorbing water and shading the stream. To receive an A, the riparian zone must be at least 18 yards wide on each side of the stream.




Available Cover: A component of total habitat, which looks at the quantity and variety of structures in the creek that provide fish and bugs a place to hide, feed, reproduce and raise young. Examples include cobble and boulders, fallen trees, logs, branches, root mats, undercut banks and aquatic vegetation.


Canoe Creek


Site #	Creek Name										Site Grade
1	Canoe Creek	C	C	D+	D	B					C
2	Canoe Creek	C	C+	D	C	C					C
3	Canoe Creek	D-	C-	D	D	B-					D+
4	Canoe Creek	B	C	D	F	B					C-
5	Sellers Ditch	B	C+	D-	F	D+					C-
6	Canoe Creek	B+	C	D-	F	D+					C-
7	Canoe Creek	C+	C+	D-	F	C					C-
8	Tributary to Canoe Creek	B	B	D	F	C					C-
9	Barrett Ditch	A	C	C	F	C-					C
10	Wilson Creek	A-	C	D+	F	C					C-
	Sign Grade	B-	C	D	F+	C					C-

Positives


 DO levels, for the most part, were suitable for fish and bugs. The lower DO grades at sites 1, 2, 3 and 7 probably resulted from low flow during the summer months.

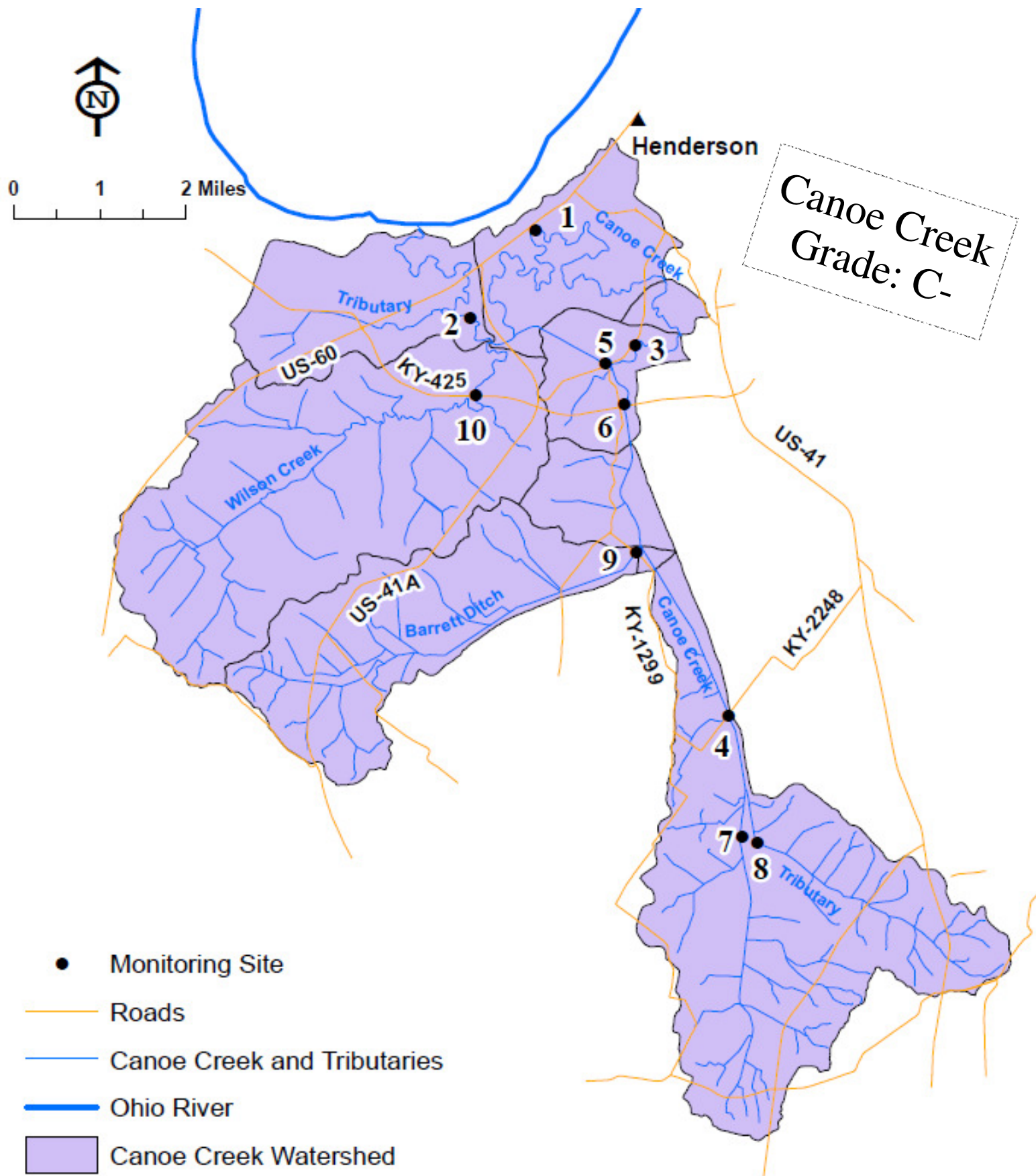
Gray Area

 TSS levels rose following rain events due to a lack of vegetation, which stabilize stream banks, and development, which exposes sediment that can then be washed away.


 Specific conductivity was outside its optimal range, which could negatively impact fish and aquatic bug communities.

Negatives










 *E. coli* levels were above the standard considered safe for swimming 80 to 100% of the time if the grade was an F, 60 to 80% of the time if the grade was a D, and 40 to 60% of the time if the grade was a C.



Negatives continued

 Nitrogen and phosphorous levels were outside their optimal ranges most of the time. These elevated levels were likely caused by agricultural runoff, urban runoff, and/or animal waste.

East Fork Canoe Creek

Site #	Creek Name										Site Grade
1	East Fork Canoe Creek	B	C			C+					C+
2	Tributary to East Fork Canoe Creek	B	C	C-	F	B					C
3	East Fork Canoe Creek	C	C	D	F	B-	F	F	F	F	D
	Sign Grade	B-	C	C+	F	B-	F	F	F	F	D

Positives



TSS levels were lower in the East Fork Canoe Creek Watershed when compared to other tributaries of Canoe Creek.



DO levels were suitable for fish and aquatic bugs. The lower DO grade at site 3 probably resulted from low flow during the summer months.

Gray Area



For the most part, nitrogen and phosphorous levels were reasonable but rose following rain events due to pollution entering the stream with runoff.



Specific conductivity levels were outside their optimal ranges, which could negatively impact fish and bug communities.

Negatives



E. coli levels were never below the standard considered safe for swimming.



Available cover is greatly reduced throughout the watershed. Not only is available cover an important place for fish and bugs to live, feed, hide from predators and mate, it also provides habitat for beneficial bacteria, which are eaten by the bugs that are then eaten by the fish.



The width of the riparian zone was less than 6 yards if the site received an F. When trees are cut and banks are cleared, algal communities bloom and water temperatures increase due to a lack of shade, banks become less stable, which increases erosion, and habitat for fish and bugs is reduced.

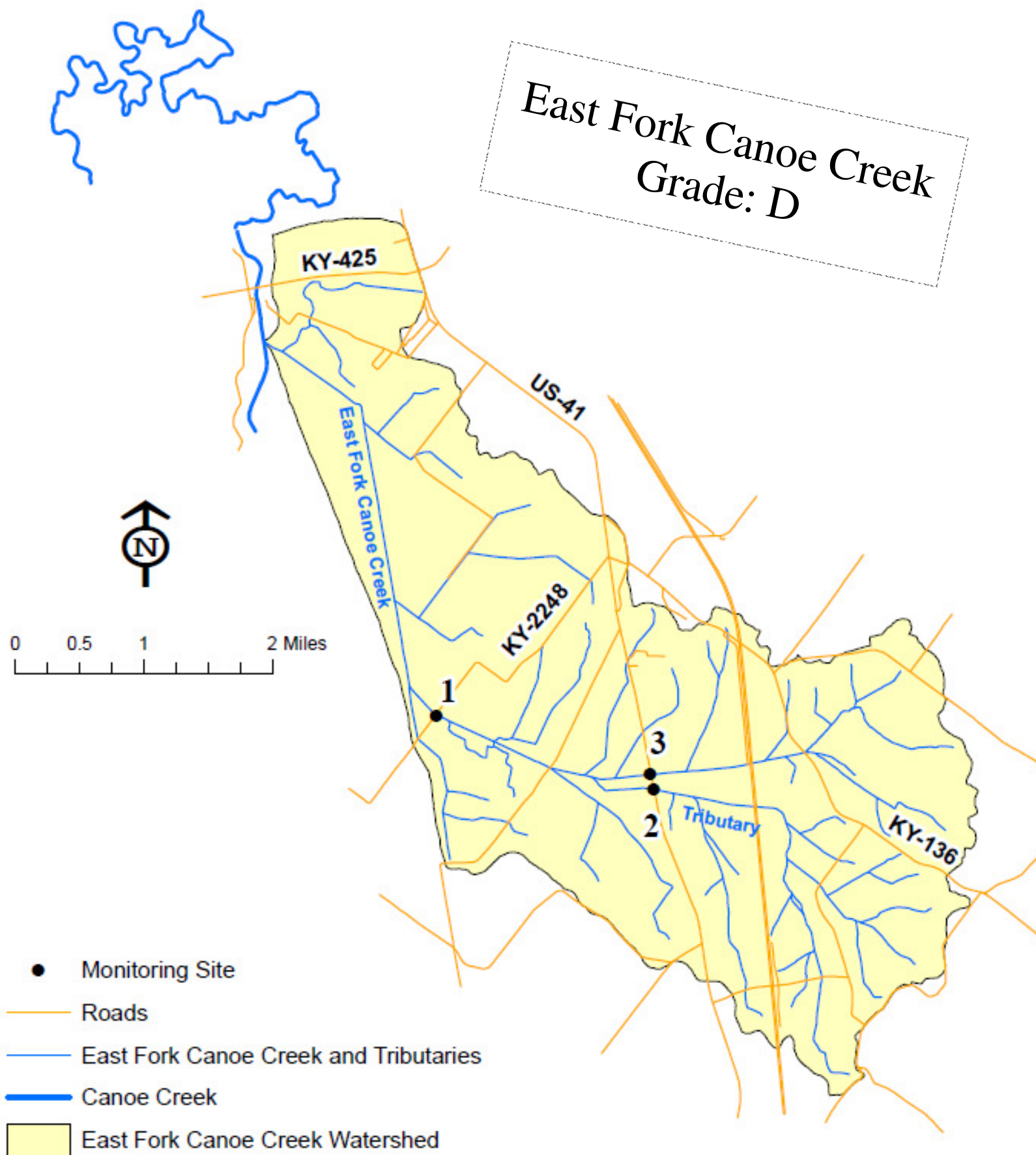


Habitat, which provides the building blocks for diverse groups of fish and bugs, was almost entirely absent.












As a result of increased specific conductivity and nutrients and reduced available cover, riparian zone and habitat, the bug communities were poor throughout the watershed. Without bugs to eat, many fish will swim to other streams in search of food.

East Fork Canoe Creek
Grade: D



Elam Ditch

Site #	Creek Name										Site Grade
1	Elam Ditch	C	C	D-	D	C-					C-
2	Tributary to Elam Ditch	B-	C+	D	F	C+					C-
3	Elam Ditch	B	C+	D	D	C	F	F	F	F	D
	Sign Grade	B-	C+	D	D-	C	F	F	F	F	D

Positives

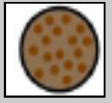


DO levels were suitable for fish and bugs. The lower DO grade at site 1 probably resulted from low flow during the summer months.

Gray Area



Elam Ditch had elevated levels of specific conductivity, indicating some type of discharge is increasing the dissolved solid content.



TSS levels rose following rain events due to a lack of vegetation, which stabilizes stream banks, and development, which exposes sediment that can then be washed away.

Negatives



As a whole, Elam Ditch was above the standard considered safe for swimming 82% of the time.



Nitrogen and phosphorous levels were outside their optimal ranges most of the time. These elevated levels were likely caused by agricultural runoff, urban runoff, and/or animal waste.



Available cover is greatly reduced throughout the watershed. Not only is available cover an important place for fish and bugs to live, feed, hide from predators and mate, it also provides habitat for beneficial bacteria, which are eaten by the bugs that are then eaten by the fish.



The width of the riparian zone was less than 6 yards if the site received an F. When trees are cut and banks are cleared, algal communities bloom and water temperatures increase due to a lack of shade, banks become less stable, which increases erosion, and habitat for fish and bugs is reduced.



Habitat, which provides the building blocks for diverse groups of fish and bugs, was almost entirely absent.

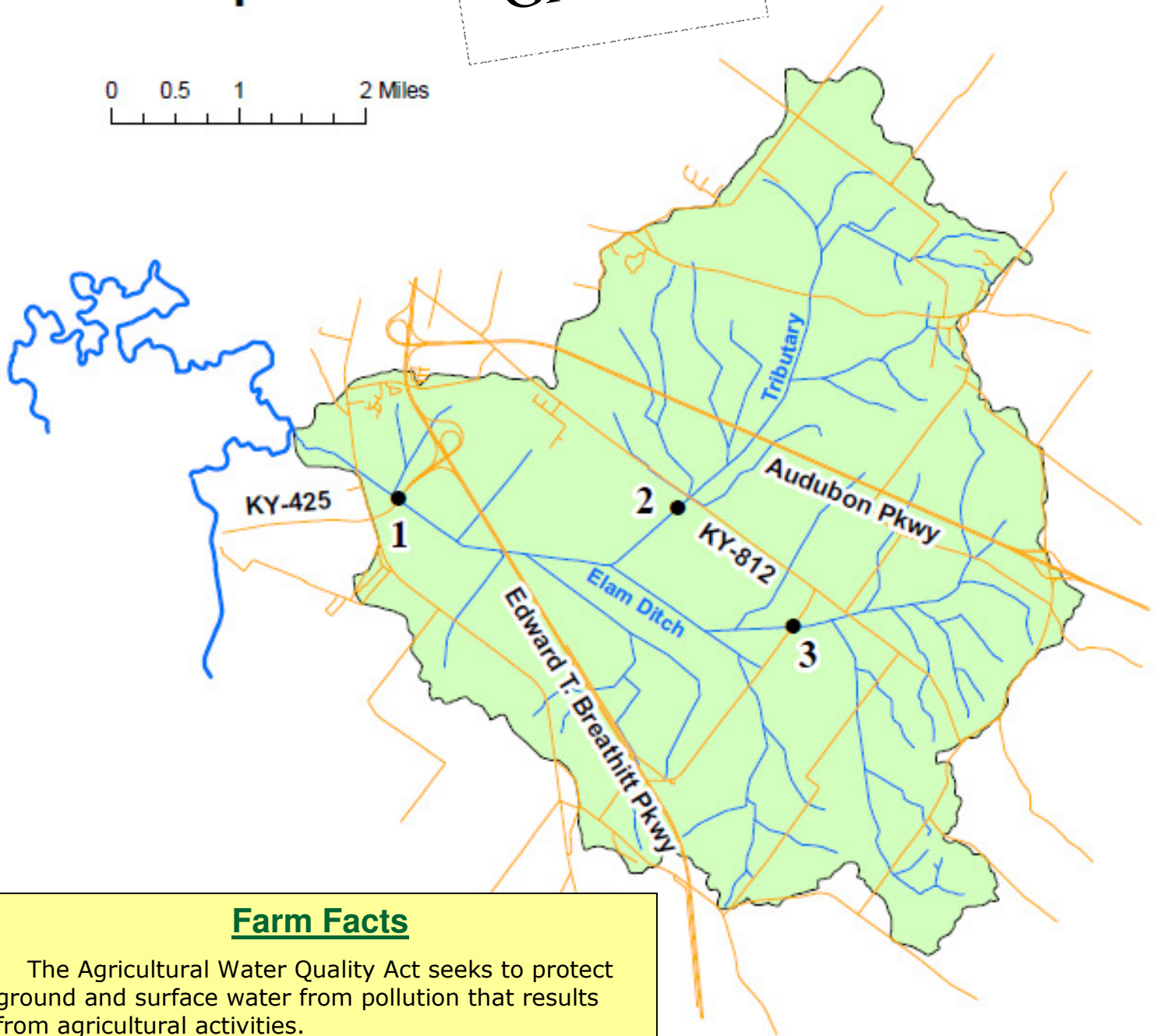


As a result of increased specific conductivity, TSS and nutrients and reduced available cover, riparian zone and habitat, the bug communities were poor throughout the watershed. Without bugs to eat, many fish will swim to other streams in search of food.



Elam Ditch Grade: D

0 0.5 1 2 Miles



Farm Facts

The Agricultural Water Quality Act seeks to protect ground and surface water from pollution that results from agricultural activities.

- To learn more about the Act visit the Division of Conservation's website at <http://conservation.ky.gov/Pages/AgricultureWaterQuality.aspx>

All landowners with 10 or more acres of agricultural activity should have a Water Quality Plan.

- To create yours, visit the KY Agricultural Water Quality Planning Tool at <http://warehouse.ca.uky.edu/AWQP2000/index.html>

A list of Best Management Practices can be found at <http://warehouse.ca.uky.edu/AWQP2000/alIBMP.html>

● Monitoring Site










— Roads

— Elam Ditch and Tributaries

— Canoe Creek

■ Elam Ditch Watershed

West Fork Canoe Creek

Site #	Creek Name										Site Grade
1	West Fork Canoe Creek	B	C+	D	F	C+					C-
2	West Fork Canoe Creek	B	C+	F+	F	C					C-
3	Tributary to West Fork Canoe Creek	B-	B-	D	F	C	F	D	F	F	D
	Sign Grade	B	C+	D-	F	C	D	F	F	F	D

Positives



DO levels were suitable for fish and bugs.

Gray Area



West Fork Canoe Creek had elevated levels of specific conductivity, indicating some type of discharge is increasing the dissolved solid content.



TSS levels rose following rain events due to a lack of vegetation, which stabilize stream banks, and development, which exposes sediment that can then be washed away.

Negatives



E. coli levels were never below the standard considered safe for swimming.



Nitrogen and phosphorous levels were outside their optimal ranges most of the time. These elevated levels were likely caused by agricultural runoff, urban runoff, and/or animal waste.



Available cover is greatly reduced throughout the watershed. Not only is available cover an important place for fish and bugs to live, feed, hide from predators and mate, it also provides habitat for beneficial bacteria, which are eaten by the bugs that are then eaten by the fish.



The width of the riparian zone was less than 6 yards if the site received an F. When trees are cut and banks are cleared, algal communities bloom and water temperatures increase due to a lack of shade, banks become less stable, which increases erosion, and habitat for fish and bugs is reduced.

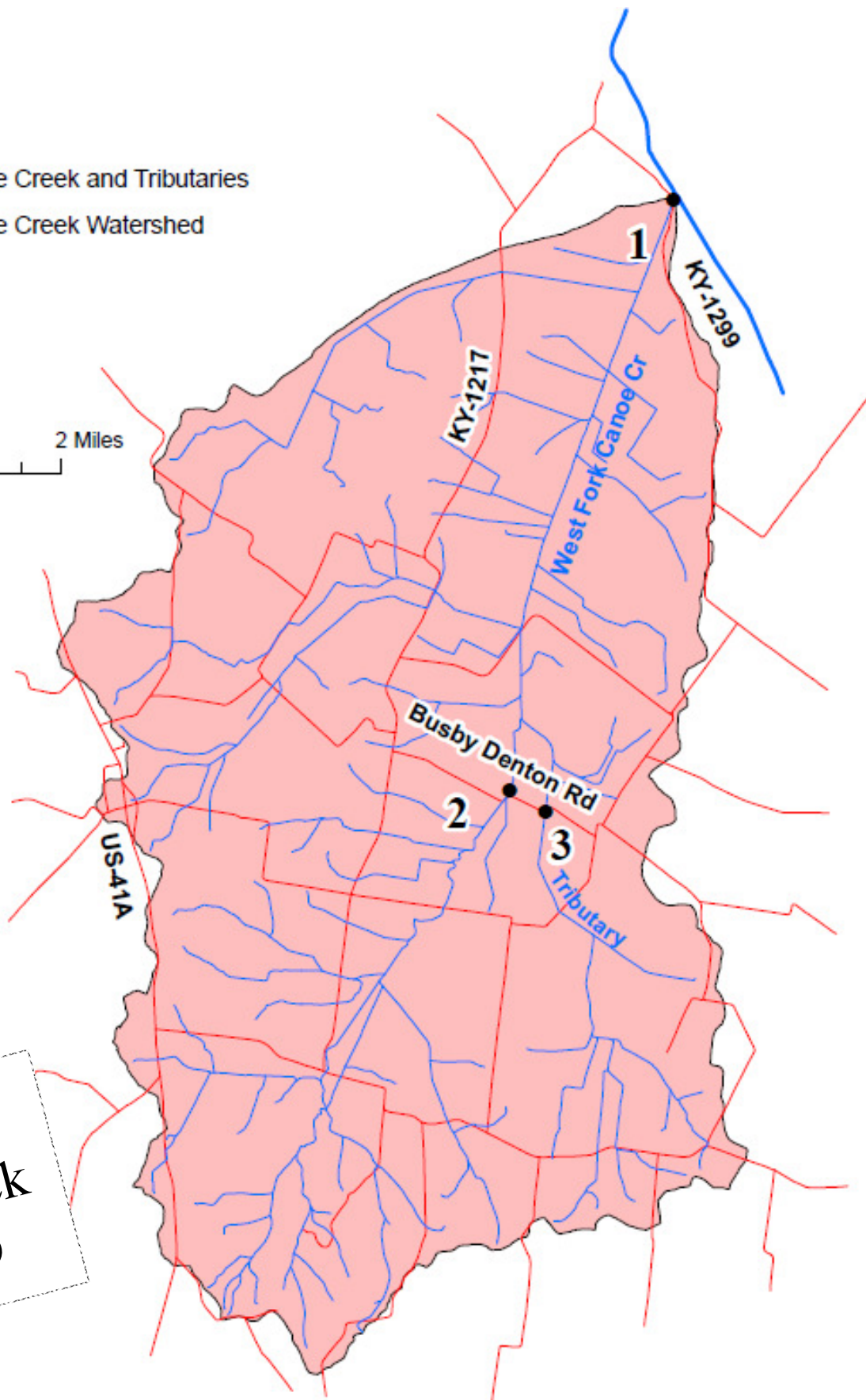


Habitat, which provides the building blocks for diverse groups of fish and bugs, was almost entirely absent.

- Monitoring Site
- Roads
- Canoe Creek
- West Fork Canoe Creek and Tributaries
- West Fork Canoe Creek Watershed



0 0.5 1 2 Miles



West Fork
Canoe Creek
Grade: D

Negatives continued:



As a result of increased specific conductivity, TSS and nutrients and reduced available cover, riparian zone and habitat, the bug communities were poor throughout the watershed. Without bugs to eat, many fish will swim to other streams in search of food.

North Fork Canoe Creek

Positives



TSS levels were lower in the North Fork Canoe Creek Watershed when compared to other tributaries of Canoe Creek.

Gray Area



DO levels at site 2 were suitable for fish and aquatic bugs. The lower DO grade at site 1 probably resulted from low flow during the summer months.



For the most part, nitrogen and phosphorous levels were reasonable but rose following rain events due to pollution entering the stream with runoff.



Elevated levels of specific conductivity indicate some type of pollution is increasing the dissolved solid content. This watershed contains more urban development that could contribute to higher conductivity levels. However, conductivity levels in this watershed were comparable to those in other watersheds. Regardless of the source, increased levels of specific conductivity negatively impact fish and aquatic bugs.

Negatives



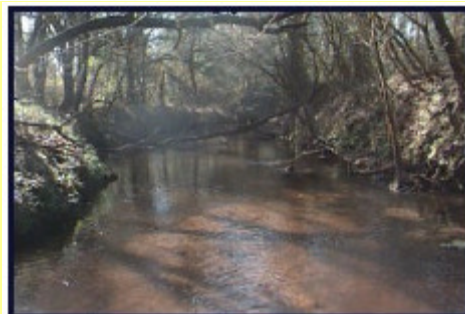
E. coli levels were never below the standard considered safe for swimming.

Habitat 101

- Compare the amount of instream material for aquatic bugs and fish to utilize for colonization, hiding and feeding.
- Compare the amount of food sources.
- Compare the amount of stream shading.
- Compare the number of stream bends, which slow water and reduce its energy, thereby reducing flood potential.
- Compare the stability of the banks.
- Compare the potential for sediment from the banks to erode when vegetative protection is lacking.








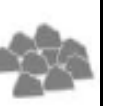

Photos from Barbour *et al.* 1999

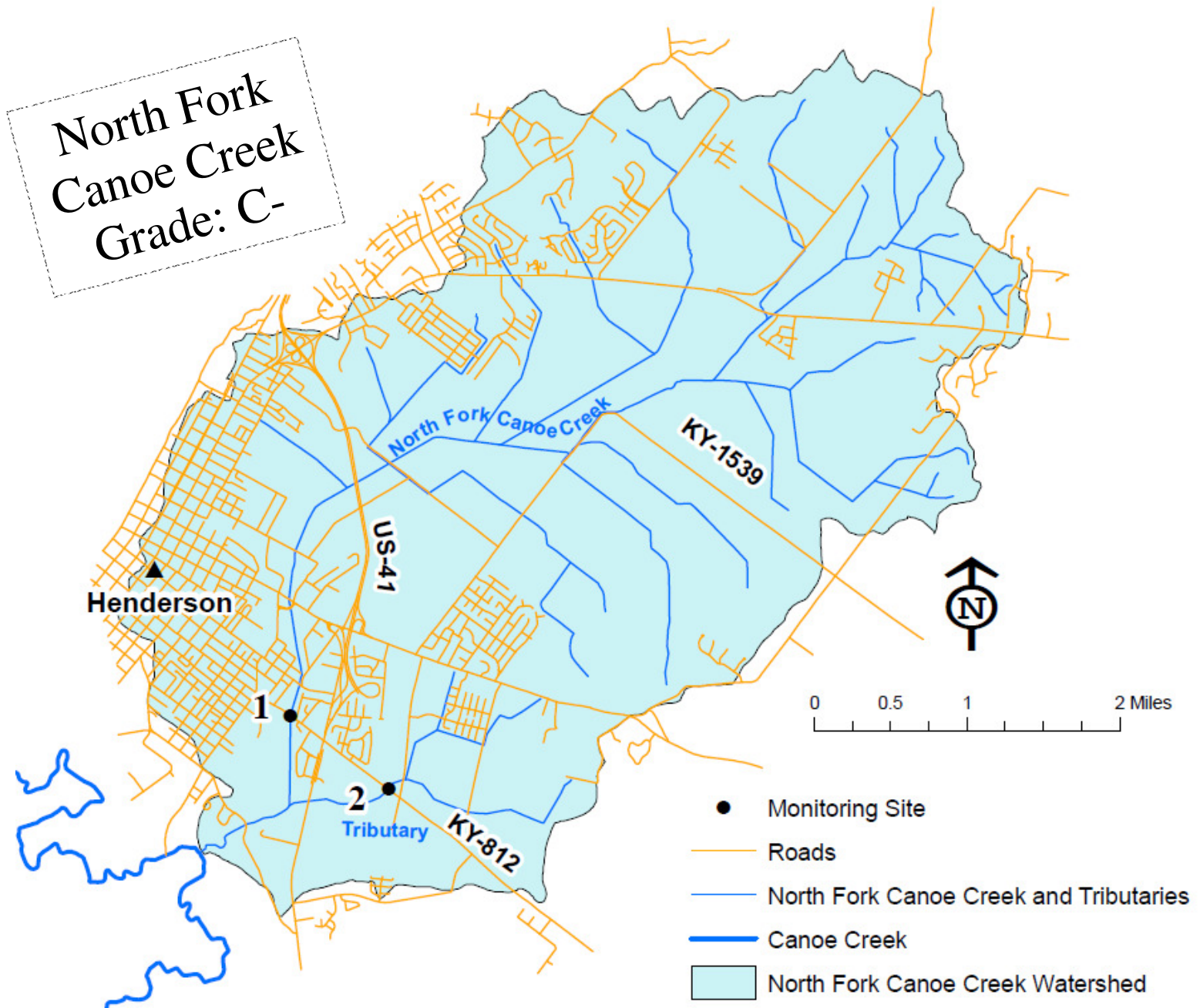
Optimal Range



Poor Range



Site #	Creek Name										Site Grade
1	North Fork Canoe Creek	C	C	C	F	B					C
2	Tributary to North Fork Canoe Creek	B-	C-	C-	F	C					C-
	Sign Grade	C+	C	C-	F	B-					C-



Summary: Room for improvement, but some have more work to do than others

Best Site: With all criteria considered, no one site stood out as better than the others. No site received a letter grade higher than a C, and all sites have room for improvement.

Best Watershed: Canoe Creek and North Fork Canoe Creek tied for healthiest watershed, each receiving a C-. However, these watersheds have room for improvement, especially when it comes to the *E. coli* scores.

Best Sign: Dissolved oxygen was the sign of watershed health that consistently received the highest grade, demonstrating that the concentration of oxygen dissolved in the water was near normal levels.

Worst Site: Canoe Creek's site 3 off Freetown Road received a D+ based on water quality data.

Worst Watershed: Elam Ditch was the most unhealthy watershed, scoring poorly in both water quality and biological health categories. West Fork Canoe Creek had worse water quality than Elam Ditch, but scored higher in biological health.

Worst Sign: A tie between total habitat and *E. coli*. Stream habitat was almost always lacking, which reduces the types and numbers of fish and bugs that can live there. Additionally, at all sites in all watersheds, *E. coli* levels were consistently above the level considered safe for swimming. *E. coli* never received a passing score at a majority of the sites.

What can you do?

- Work with the local government and land owners to **protect the areas that are less degraded** and improve land management to minimize further degradation.
- **Trees are the best way to protect and restore water quality and biological health.**
 - ◊ Leave in place or establish vegetation alongside streams to provide natural filters that stabilize stream banks, minimize erosion, regulate water flow, provide shade, retain sediment and absorb excess nutrients.
 - ◊ Plant trees and do not mow within 18 yards of the stream bank.
- **To keep water safe for swimming**, keep animals out of the streams, which will limit the amount of animal waste entering the waterways, and report septic and sewer problems.
- **To improve habitat**, allow fallen trees, logs, leaves, gravel, cobble and boulders to remain in the stream to create habitat for fish and bugs to feed, find refuge and reproduce.
- **To reduce TSS**, maintain streamside vegetation, plant cover crops, install settling ponds and properly guard waterways during construction activities.
- **By reducing TSS**, toxins and metals, which bind to sediment, will also be reduced.
- **To reduce nutrients:**
 - ◊ Use chemicals and pesticides according to labels and use fertilizers based on soil test results. Limit uses and store and dispose of properly.
 - ◊ Report septic and sewer problems, such as sewer leaks and overflow.
 - ◊ Properly dispose of pet waste.
 - ◊ Keep animals out of the stream.
- Keep grass clippings, petroleum products, trash, and litter out of storm drains. This material enters the stream directly without treatment.
- Service your vehicle regularly to prevent oil and antifreeze leaks and reduce noxious emissions.
- Become a certified citizen **volunteer** water quality monitor or establish a program in your local community or watershed.

Where to go for more information

Making changes at home and work

- Bluegrass PRIDE at www.bgpride.org/gallery1.htm

Volunteering

- Watershed Watch in Kentucky at water.ky.gov/wsw/Pages/default.aspx or contact Jo Ann Palmer at 800-928-0045 or JoAnn.Palmer@ky.gov

Purchasing or planting native trees and plants

- Division of Forestry: forestry.ky.gov/Pages/default.aspx
- Kentucky Native Plant Society: www.knps.org/plant_resources.html

Grants and Programs

- KY's Nonpoint Source (Runoff) Pollution program: water.ky.gov/nsp/Pages/default.aspx
- KY's Natural Resource Conservation Service: www.ky.nrcs.usda.gov/
- KY's 319 Grant program: water.ky.gov/Funding/Pages/NonpointSource.aspx or contact James Roe at 502-564-3410 or James.Roe@ky.gov
- Hinkston Creek Watershed Protection Project: <http://www.hinkstoncreek.org/index.html>
- KY's Department of Agriculture **free** farm chemical collections: <http://www.kyagr.com/consumer/envsvs/technical/FarmChemicals.htm>